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The real-time tight integration of High-rate GNSS and strong motion records using IGS RTS products

Jianfei Zang (1), Caijun Xu (1,2), Guanxu Chen (1), and Shijie Fan (3)

(1) School of Geodesy and Geomatics, Wuhan University, Wuhan, China (cjxu@sgg.whu.edu.cn), (2) Key Laboratory of Geospace Environment and Geodesy, Ministry of Education, Wuhan University, Wuhan, China , (3) School of Geosciences, China University of Petroleum, Qingdao, China

The real-time retrieval of highly accurate seismic waveforms is essential for the earthquake early warning and fault rupture process inversion. Although the traditional strong motion(SM) sensor can record seismic waveforms with very high accuracy and frequency, it suffers from baseline errors due to the tilt or rotation of the instrument. Compared with the SM, the High-rate GNSS can record ground displacements directly without drift. But it has higher noise and lower sampling rate than that of SM. To complement the advantages of High-rate GNSS and SM, the PPP-based tight integration methods of two sensors have been proposed in the past few years. However, limited by the precise orbit and clock products, it is not possible for traditional PPP to record seismic waveforms in real time. In April 2013, the international GNSS service(IGS) issued the real-time service(RTS), which makes the real-time tight integration of High-rate GNSS and strong motion records possible. Therefore, based on the IGS RTS products, we analyzed the performance of the real-time PPP-based tight integration of two sensors using co-located records collected during the 2016 Mw 7.8 earthquake in New Zealand and 2016 Mw 6.5 earthquake in central Italy in a simulated real-time mode. The results show that the real-time combined displacements include more abundant seismic signals without clipping and drift if the baseline shift is estimated as a random walk process, and the RMSE(Root Mean Square Error) in the North, East and Up component is 3mm, 3mm and 6mm separately while taking post combined displacements as a reference.